Subject: L.R.Ember's article on Yellow Rain in C&EN, Jan. 9, 1984

The article has value by virtue of its listing of people who have contributed data and ideas concerning yellow rain. However, the article appears to be biased against the government's case for yellow rain as a military action and in favor of the arguments against the government's case. The bias is manifest in the author's value judgements, two-valued (either/or, all/none) statements, and inferences based on speculation. In some instances these manifestations of bias lead the author into error or self-contradiction. For example, on p.10 par.7 the author states that except for a gas mask, all positive samples (positive for mycotoxin) have come from one private laboratory. However, in addition to the positive findings of C.J.Mirocha, which are cited frequently in the article, the author indicates that J.D.Rosen obtained a positive result on the ABC sample (p.11 last par.), and that H.B.Schiefer corroborated Mirocha's findings (p.17 par.6). E.W.Sarver and Mirocha both found T-2 on the gas mask from Afghanistan (p.18 last par.), but the author states that not one piece of military hardware has tested positive for toxins (p10 par.7). On p.19 par.2 one reads that the "single gas mask is the sum total of the government's physical evidence", yet surely the samples listed in the table on pp. 18 & 19 are physical evidence samples.

In an effort to discount the credibility of body fluid samples collected more than several days after a person claimed to have been exposed to yellow rain, the author repeatedly refers to animal studies that show tricothecenes to have only a brief residence time in the body (p.14 last par., p.20 par.2, p.20 last par., p.21 par.11, p.25 par.4). However, in referring to D.L.Brunner's finding that a dose to the skin is not completely absorbed into the body after a month, the author calls the government's studies ambiguous (p.21 last par.). While Brunner's results are called into question (p.22 pars.1 & 2), no equivalent level of questionning is applied to the rapid clearance findings re oral or i.v. doses.

The author makes much of the fact that Sarver did not corroborate Mirocha's results on the rock scraping sample (Govt. No. FS 704B. see table, p. 18). Reference is made to chemists who think that T-2 could not degrade in the year interval between Mirocha's results and Sarver's analysis (p. 17 pars. 4 & 6). In par. 6 of p. 17 the author calls this a "startling" discrepency and M.S.Meselson is portrayed as nonplussed by it. The author did not seem to realize the importance of other information in this article relevant to the problem:

(1) The extraction procedures that Mirocha and Sarver use are different, and neither recovers more than 10% of tricothecene in the kind of sample in question (Mirocha-p.16 par.4, Sarver-p.17 par.5). Thus, there is a significant problem with T-2 recovery. Where evaporation can be ruled out, degradation and binding are candidate explanations for poor recovery of a compound. Given that the chemist's cited by the author

are correct that T-2 would not significantly degrade in one year in the sample in question, it is still possible that T-2 could be progressively bound to something else in the sample and rendered less extractable with time.

I'm not convinced that T-2 degradation can be ruled out in the sample in question. T-2 is an epoxide compound, and the epoxide group is quite reactive. The sample is a rock scraping, and specs of rock in the sample could act as a catalyst for T-2 reaction with another sample ingredient or moisture in the air..

(2) On p.33 par.2 the author cites the fact that, without careful control, the GC-MS procedure (which both Mirocha and Sarver use) can give false positives or negatives very easily. She should have noted that the data obtained by both chemists show an absence of false positives, which attests to careful control on the part of both persons.

The presence of pollen and bee feces in yellow rain is given considerable space (pp.22-26). The author flatly states that, "if yellow rain is bee feces, it discredits the government's case." The government's idea that pollen might be deliberately used to carry tricothecenes (p.23 par. 1) is debunked, and Meselson is the chief debunker cited for this purpose (e.g., p.25 par.7, "It's incredible that anyone would use pollen. It's very, very outlandish. Then for it to be Southeast Asian pollen!"

Actually, of course, there could be some very good reasons why pollen and/or (bee feces) may be used to carry tricothecenes:

(1) Consider the difficulty in differentiaten between a natural and man-made agent, as evidenced by the subject article, when agent is mixed with naturally occurring material;

(2) These carriers may confer some desired properties, such as tailor-made persistence or dose delivery enhancement.

With regard to bee feces, Shiefer questions the theory that the bee feces explanation of yellow rain in the present case by asking why the heavy amounts of bee defecation seems to occur only in militarily contested areas (p.24 par.2). The author does not comment on that particularly germane observation. (Maybe the bees are scared _____?)

Notably absent from the article are some of the calculations that can be performed on the data presented. For example, some interesting calculations can be put together using W.B.Buck's studies of T-2 retention in swine and cattle following an oral dose (p.21 par.12), Brunner's findings with respect to skin retention (p.21 last par.), and the level of T-2 in the blood of some victims (table, pp.18-19). Given a typical blood level of about 10 ppb, there would be about 30 micrograms in the person's 3 liters of blood plasma. One half of this would be replaced every 15 minutes from some depot (probably skin). We will assume a skin dose and skin depot, since these are consistent with aerial delivery and Bruner's findings. If the sample were taken four weeks after dose delivery and the 15 micrograms were replaced every 15 minutes in the blood from the depot, then the initial depot level was at least 40 milligrams. Given that an individual presents about 0.4 sq. meter to a falling spray, then the delivery was at least 100 mg. per sq. meter, which corresponds to about 400 g/acre. Given that the discrepancy between Mirocha and Sarver's analytical results on the rock scraping sample was due to degradation of T-2 facilitated by sample ingredients, and assuming that the degradation reaction was underway prior to the sample collection (it could have been more rapid before sample collection than after), then the initial T-2 concentration in the yellow rain could have been on the order of 1% by weight. If so, then the delivery could have been on the order of 40

kg/acre, which is well within the capability of delivery by an ordinary crop-duster aircraft.

Similarly, the data quoted from the Chinese paper (p.25 last par.) are worth some attention: i.e., a 20 minute descent of yellow rain covering 20 acres with a viscous liquid to about 160 spots of liquid per square meter implies 1.3E7 spots/20 acres. It is said that the spots were a few mm in size, so assume that the average radius was 0.2 cm. Since the fluid was viscous, assume an average height of 0.2 cm. Then the total volume of the material was about 330 liters, and if the density was unity the total weight was 330 kg. The material is surmised to be fecal material from bees (p.26 par.1). If we assume the average bee weighs 500 mg and can defecate 5% of its body weight, then the yellow rain in this case was caused by about 12 million bees. One would think that, if the yellow rain in the case of Southeast Asia were similarly caused by bees, surely the victims of yellow rain might have noticed the some millions of bees that would have been responsible.

Usually the articles in C&EN are very well written, informative, and help busy people improve their understanding of subjects outside of their fields of expertise. Unfortunately, the subject article falls far short of the usual standards. Because of its bias, which is apparent by virtue of its language, it imposes upon the reader a considerable level of effort to try to understand the true merits of the government's case.